

MATING BEHAVIOR OF WATER PENNY BEETLES (COLEOPTERA: PSEPHENIDAE): A HYPOTHESIS

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ABSTRACT

Water penny beetles exhibit a "play" behavior on wave splashed rocks in stream riffles, here interpreted as part of the mating behavior. Copulation has been observed 3 times in the laboratory and only twice in the field despite numerous observations over several years. The only explanation of this apparent lack of mating consistent with all the data is that females are at the mating site for such a short time that the act goes unnoticed.

Adult water penny beetles of the genus *Psephenus* perform a strange ritual on wave splashed rocks in riffle habitats. Hubbard (1880) called it a "play" behavior which is probably as good a description as possible. West (1929) interpreted it as a form of courtship and gave a detailed, lively description of what he saw. Since that paper is virtually impossible to find in libraries, it seems worthwhile to reproduce it here.

"An individual, presumably a female, will pause for moment, after running frantically over the surface of the rock, and rest, with head toward the water, the mouth parts sometimes touching the surface. This attitude of itself may have nought to do with mating, but it is frequently at such a time, that a second individual presumably the male, runs up to the first, apparently in a very excited mood, and explores the posterior end of the first, with antennae and palps. The first invariably whirls about, and sometimes, if the second pauses long enough, returns the salutation by exploring, in the same manner the pygidium of the male. The next step is a dizzy chasing back and forth of the two, which usually terminates in a tangled embrace of antennae, palpi, and legs, the ventral surfaces being approximated. Such a position of course, leaves them nothing with which to cling to the slippery surface, and the most usual result is for the pair to roll off the rock, though they sometimes separate without doing so. If they do fall to the water they release the embrace the instant they strike the surface, and fly to the same, or a new stone where the performance may be repeated several times. Action is so rapid throughout these maneuvers that I am unable to say whether copulation actually occurs, but much careful observation has failed to disclose anything more like mating than the procedure described above. After four or five repetitions of this performance, they will usually rest, sitting sluggishly, a few inches apart."

West was a good observer, and his conclusions are reasonable, though incorrect. The behavior pattern is essentially as follows. When active, the beetles run back and forth horizontally on the wet or moist surfaces of rocks projecting from the stream in turbulent areas. The running is best described as scurrying, and "excited" is a good anthropomorphic term that fits

this behavior. The beetles often appear to chase each other and then whirl about, suddenly running off in opposite directions. Two or more beetles may "deliberately" bump each other even when there is ample room to pass and may become entangled for a second or so. They separate and usually go off in separate directions. The running speed is about 4-7 cm per second in *P. falli* (Murvosh, unpublished data). This play behavior is repeated over and over. At irregular intervals the beetles stop running, often all at once, and stand motionless at the water's edge usually with the head facing the water. Murvosh (1971) reported 50 adults of *P. herricki* lined up like this on a single boulder. It is more usual to see just a few beetles per rock. What is interesting is the precise synchrony with which the beetles simultaneously start or stop running when there are several on a rock.

The chase, play, and rest pattern is usually performed about midmorning to midafternoon. Prior to and after that the beetles remain pretty much motionless on the rock somewhere near the water line. The pattern described seems quite stereotyped for *P. herricki*, *P. texanus*, *P. falli*, and 2 species from central Arizona. There may be subtle species differences such as found for *P. falli* (Murvosh, unpublished data); these do not become entangled but tend to bump each other slightly, then run off. Brown and Murvosh (1974) described a new species of water penny, *P. montanus*, from the White Mountains of Arizona; it has not been observed to exhibit any of the described phenomena, and is restricted to shore areas rather than turbulent microhabitats (Murvosh and Brown, unpublished data).

We assume that the chase and play activity is part of the mating process, but actual copulation is rare or rarely seen. West apparently never witnessed copulation and we seem to be the only ones who have. Murvosh saw it twice with *P. herricki* in the field and Brown has seen it 3 times in the laboratory—twice with *P. herricki* and once with *P. arizonensis*. Paul Spangler (pers. comm.) who has also studied them has not observed copulation.

The behavior of these beetles has been watched rather intently at varying intervals during the past 15 years, so this apparent lack of mating requires some explanations. We have reviewed the information that bears on this problem and attempted to synthesize a hypothesis consistent with these data.

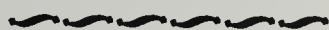
Parthenogenesis was temporarily suspected but a couple of unmated females, taken from pupae, laid eggs which did not hatch in the laboratory. Aerial mating cannot be completely discredited but field observations suggest this is doubtful. H. H. Ross (pers. comm.) once suggested the possibility that mating might occur at some critical time such as at dusk or dawn. Observations since then suggest otherwise. The quieting down of the beetles and their inactive state seem to preclude nocturnal mating. Nocturnal observations thus far have been negative.

More significant in a positive way are these facts. Observed copulation has been on the rocks where activity occurs. Adults respond positively to water or moist wet surfaces and are almost never found on shore or in dry areas during the heat of the day. The time of observed copulation is short: from a few seconds to about a minute. Females oviposit on the undersurfaces of stones where the play activity occurs or on adjacent rocks and die afterwards without coming to the surface. With few exceptions, the beetles running about the rock are all males, not a mixture of males and females, and this single fact seems to account for the lack of mating. We

suggest the following hypothesis to explain what actually happens. A female emerges from the pupal stage beneath a rock at the moist shore area and flies to a wave splashed riffle rock precisely where males are likely to be congregated. She is receptive to a male and copulates immediately, the process requiring less than a minute. After mating she promptly crawls down the edge of the rock, enters the water, and remains there to oviposit and die. The whole act goes unnoticed since females are at the mating site for such a short period of time.

LITERATURE CITED

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QUEDIUS TRANSPARENS MOTSCH., A VALID SPECIES
(COLEOPTERA: STAPHYLINIDAE)

(102ND CONTRIBUTION TO THE
KNOWLEDGE OF STAPHYLINIDAE)

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ABSTRACT

The type material of *Quedius transparens* Motschulsky 1845, deposited at the Museum of Zoology, Moscow State University, Moscow, U.S.S.R., has been studied and a lectotype designated. *Quedius marginalis* Mäklin 1852 and *Q. pugetensis* Hatch 1957 are junior synonyms of this species.

Quedius transparens was described by Motschulsky (1845:358) from specimens from California. It has not been mentioned in the literature since then, except in catalogues, and was considered a *species dubia* more recently. In his catalogue, LeConte (1863:23) correctly placed the species in front of *Q. bardus* Melsh. (synonym of *Q. capucinus* Grav.), but Henshaw (1885:33) catalogued the species as a possible synonym of *Q. molochinus* Grav. In Leng's (1920:110) catalogue, it was assigned, for no apparent